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ABSTRACT

This paper summarizes a study that assessed the effects of an extended case study that focused on wetland issues with seventh and eighth grade students. The extended case study is an instructional methodology that incorporates the issue investigation/evaluation and action training model. A modified pretest-posttest nonequivalent control group design was utilized with fifteen intact classes from Illinois and Missouri. Posttest data were collected on the variables of overt environmental behavior, knowledge of ecological foundations, individual locus of control, group locus of control, knowledge of citizenship action skills, and perceived skill in the use of citizenship action skills. Analysis of covariance was used to compare treatment groups and control group means. Statistically significant differences were found with the variable overt environmental behavior. The two experimental treatments were found to be more effective than the control, and the full treatment was found to be more effective then the partial treatment in increasing overt environmental behavior. (Author)

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THE EFFECTS OF AN EXTENDED CASE STUDY ON ENVIRONMENTAL BEHAVIOR AND ASSOCIATED VARIABLES IN SEVENTH AND EIGHTH GRADE STUDENTS

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by

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ABSTRACT

This paper summarizes a study that assessed the effects of an extended case study that focused on wetland issues with seventh and eighth grade students. The extended case study is an instructional methodology that incorporates the issue investigation/evaluation and action training model. A modified pretest-posttest nonequivalent control group design was utilized with fifteen intact classes from Illinois and Missouri. Posttest data were collected on the variables overt environmental behavior, knowledge of ecological foundations, individual locus of control, group locus of control, knowledge of citizenship action skills, and perceived skill in the use of citizenship action skills. Analysis of covariance was used to compare treatment groups and control group means. Statistically significant differences were found with the variable overt environmental behavior. The two experimental treatments were found to be more effective than the control ($F_{1,12,} = 15.34$, p=.0001) and the full treatment was found to be more effective then the partial treatment ($F_{1,12,} = 7.31$, p= 0074) in increasing overt environmental behavior.

A number of writers, Childress and Wert, (1976); Harvey, (1977); Hungerford and Peyton, (1976); Rubba and Wiesenmayer, (1985); have taken the position that producing environmentally literate citizens who demonstrate responsible environmental behavior could be considered the ultimate goal of environmental education. This goal is widely accepted among environmental educators, but assembling the links to achieve this goal becomes the challenge. Several of these links we know from the research can be found in methods of instruction related to environmental problems, issue investigation and action training. While many environmental educators agree upon the importance of environmental behavior and the associated variables, until recently only a few have incorporated this information into curriculum development projects. A review of the literature (Andrews, 1992; Pomerantz, 1991) finds that most instructional strategies and techniques are based on environmental awareness models with emphasis on ecological foundations and appreciation of environmental resources. If environmental educators are to achieve with some degree of success, the ultimate goal of responsible environmental behavior, then it becomes critical to design materials suited to the task. Curricula that provide the necessary knowledge related to environmental issues, tools to adequately review these issues and skills needed to help resolve these issues are essential. These ingredients are the proven links to success in promoting responsible environmental behavior.

Purpose

The purpose of this study was to examine the instructional effects of an extended case study (ECS) that uses the issue investigation/evaluation and action skills training model. The intent was to demonstrate that the ECS is an effective instructional methodology that can significantly increase the following cognitive and affective variables:

1. overt environmental behavior,
2. knowledge of citizenship action skills,
3. perceived skill in the use of citizenship action skills,
4. individual locus of control,
5. group locus of control, and
6. knowledge of ecological foundations.

The ECS is modeled after the "Goals for Curriculum Development in Environmental

Education" (Hungerford, Peyton and Wilke, 1980) and is designed to: (1) provide science/ecological foundations, (2) make students aware of issues (3) involve students in issue investigation and evaluation, (4) provide training in citizenship action skills necessary for learners to take positive environmental action.

Treatments

The basis for the experimental treatments in this research study was an ECS entitled, Wetlands: A Major North American Issue (Culen, 1992). This ECS addresses the four hierarchical goal levels for curriculum development in environmental education set forth by Hungerford et al., (1980).

The following text, taken from Wetlands: A Major North American Issue (WMNAI) describes the instruction used to address each of these four goal levels:

> Goal Level I: Science Foundations. In Goal Level I, students are introduced to the topics of wetlands and wetlands habitat loss. These topics include definitions of wetlands, descriptions of various types of wetlands and causes of wetland loss. (Culen, 1992, p.2)
>
> Goal Level II: Issue Awareness. In Goal Level II students are introduced to problems and issues and to the importance of human beliefs and values in environmental issues. They also develop issue analysis skills and apply them to issues associated with wetland habitat loss. (Culen, 1992, p.5)
>
> Goal Level III: Issue Investigation and Evaluation. In Goal Level III, students learn about and practice the issue investigation method. Students plan and conduct a wetlands investigation. This includes selecting research questions, using survey instruments, developing a data collection strategy and interpreting findings. (Culen.1992, p.17)
>
> Goal Level IV: Citizenship Action. In Goal Level IV, based on the data collected in Goal Level III, students list issues related to wetlands and suggest and evaluate

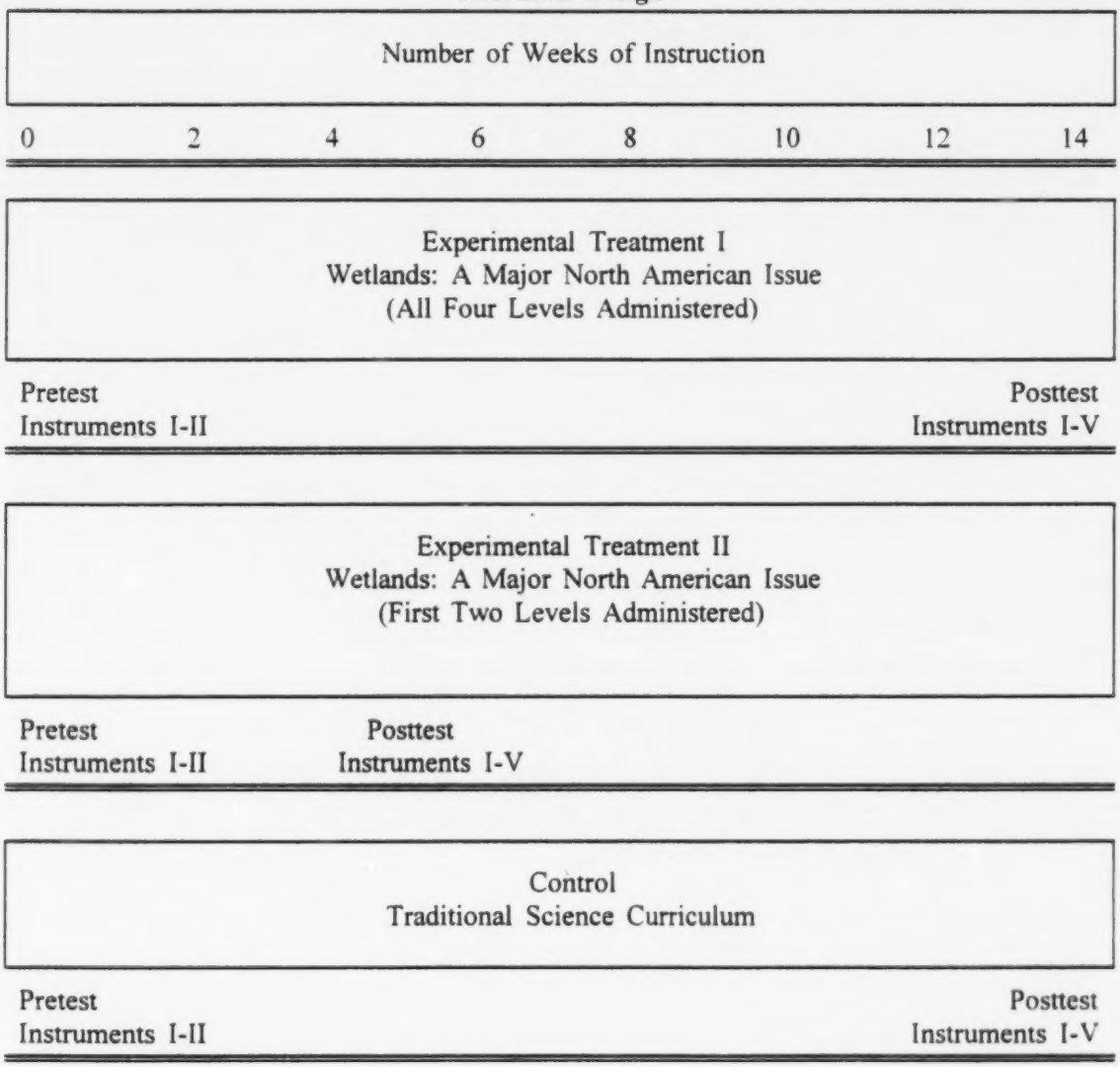
possible alternative solutions. As a group, the students select a solution on which they would like to work. They develop and evaluate an action plan designed to achieve the solution. Finally, they are given an opportunity to put this plan into action. (Culen,1992, p.27)

The duration of experimental treatment I, which included all four levels described above, was approximately ten to fourteen weeks. The duration of experimental treatment II, which included only levels one (I) and two (II) above, was four to six weeks. The students in the control group, received instruction over a twelve week period in a traditional science program based on commonly used texts which do not typically contain an issue oriented focus (see Figure 1).

Research Design

A modified pretest-posttest design was used in the research format. A pretest using Instruments I and II was used to examine the groups for evidence of differences on the criterion variables, knowledge of ecological foundations and overt environmental behavior. The analysis indicated that statistically significant differences did not exist between the groups on a pretest basis with respect to the criterion variables knowledge of ecological foundations ($F_{2,12} = 2.18$ $p = .1155$) and overt environmental behavior ($F_{2,12} = 0.86$ $p = .4244$). Therefore, the research design was designated as compromise experimental groups-control group (Kerlinger, 1986, pp.315-316).

Figure 1
Research Design



The Sample

This study involved a total of 15 intact, heterogeneously grouped seventh and eighth grade classrooms. Experimental treatment I consisted of four seventh grade classes and two eighth grade classes, experimental treatment II consisted of two seventh and two eighth grade classes and the control group consisted of two seventh and three eighth grade classes. The experimental classrooms were located in three different geographical settings. The five control classrooms were located in two different geographic settings. There were 98 students in the experimental treatment I (ETG I) sample, 72 students in the experimental

treatment II (ETG II) and 75 students in the control group (C6) sample.

The experimental treatments were delivered by four middle school teachers who participated in an in-service teacher education program focused on the investigation and evaluation of environmental issues and action (IEEIA). The control treatment was delivered by two teachers, one of which had training in (IEEIA); the other did not.

Instrumentation

Five instruments were used to collect data for this study. Instrument I (Wetlands Test) and Instrument II (Environmental Actions) were used on both a pretest and posttest basis. Instruments III (Locus of Control), IV (Knowledge of Action Skills) and V (Perceived Skill of Citizenship Action) were used on a posttest basis only to avoid possible effects of pretesting on subsequent testing. (See Figure 1) These procedures were similar to previous research studies by Ramsey (1987) and Simpson (1989).

Instrument I was developed by the researcher specifically for the WMNAI to measure knowledge gained about wetland ecosystems. Test-retest reliability was determined for Instrument I. Instruments II, III, IV and V were used in previous studies (Ramsey, 1979, 1987; Sia, 1984; Simpson, 1989). These instruments were modified by Ramsey in 1987 for use with seventh grade students. Content validity was established for instruments II-V in previous studies (Ramsey, 1987; Simpson, 1989). Test-retest reliability was also determined in previous studies.

Data Analysis

The data were analyzed to determine class means for each of the six treatment variables. Class means were also used as the unit of analysis to statistically compare the five control class means to the six experimental treatment group I class means and the four experimental treatment group II class means. Statistical analysis were completed using analysis of covariance (ANCOVA) for each of the six variables. The ANCOVA assumptions of homogeneity of variance and homogeneity of regression were satisfied. A .05 significance level was selected on an a priori basis. Because the statistical hypotheses were directional, one tailed probabilities were used in the test for significance.

Findings and Conclusions for Knowledge of Ecological Foundations

Posttest analysis of covariance on the data collected for the variable knowledge of ecological foundations (Instrument I) indicated that the least squares mean of the control group was 10.007. The least squares mean of the ETG I was 12.864 and the least squares mean of the ETG II was 11.475. Statistical analysis yielded an F ratio of 8.18 and an associated probability of .0046 (significant at .05) for the comparison of the control versus the experimental treatment groups. Comparison of ETG I and ETG II yielded an F ratio of 0.37 and an associated probability of .5424 (See Table 1).

Table 1. Planned Orthogonal Contrasts of the Posttest Means of the Variable Knowledge of Ecological Foundations Instrument I

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	51.963	51.963	8.18	.0046*
Treatment I vs Treatment II	1	2.363	2.363	0.37	.5424 (n.s.)

* = Significant at .01
n.s. = not significant

The students participating in ETG I, that received all four levels of the WMNAI extended case study, did not demonstrate statistically significant higher levels of knowledge of ecological foundations when compared to students in ETG II who received instruction in only the first two levels of the WMNAI containing only knowledge and awareness of environmental issues. Statistically significant higher levels of knowledge of ecological foundations were demonstrated when students in the ETG I and students participating in ETG II, were compared to students in the CG receiving no instruction concerning environmental issues.

Findings and Conclusions for Overt Environmental Behavior

Posttest analysis of covariance of the data collected for the variable overt environmental behavior (Instrument II) indicated that the least squares means of the CG was 0.969. The least squares mean of the ETG I was 2.340 and the least squares mean of the ETG II was 1.529. For the comparison of the control versus the experimental treatment groups statistical analysis yielded an F ratio of 15.34 and an associated probability of .0001 (significant at .05). Comparison of ETG I and ETG II yielded an F ratio of 7.31 and an associated probability of .0074 (See Table 2).

Table 2. Planned Orthogonal Contrasts of the Posttest Means of the Variable Overt Environmental Behavior Instrument II

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	35.656	35.656	15.34	.0001*
Treatment I vs Treatment II	1	16.997	16.997	7.31	.0074**

* = Significant at .001
** = significant at .01

The students participating in ETG I that received all four levels of the WMNAF extended case study demonstrated statistically significant higher levels of overt environmental behavior when compared to students who received instruction containing only knowledge and awareness of environmental issues (ETG II) or when compared to students receiving no instruction concerning environmental issues (CG).

Findings and Conclusions for Individual Locus of Control

Posttest analysis of covariance on the data collected for the variable individual locus of control (Instrument III) produced a grand mean for the CG of 2.787. The grand mean of the ETG I was 3.143 and the grand mean of the ETG II was 3.097. For the comparison of the control versus the experimental treatment groups statistical analysis yielded an F ratio of 5.98 and an associated probability of .0152 (significant at .05). Comparison of ETG I and ETG II yielded and F ratio of 0.16 and an associated probability of .6871 (See Table 3).

Table 3. Planned Orthogonal Contrasts of the Posttest Means of the Variable Individual Locus of Control Instrument III

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	4.402	4.402	5.98	.0152*
Treatment I vs Treatment II	1	0.120	0.120	0.16	.6871 (n.s.)

* = Significant at .05
n.s. = not significant

The students in ETG I did not demonstrate statistically significant higher levels of individual locus of control when compared to students in ETG II. Statistically significant higher levels of individual locus of control were demonstrated when students in ETG I and students in ETG II. were compared to the CG.

Findings and Conclusions for Group Locus of Control

Posttest analysis of covariance on the data collected for the variable group locus of control (Instrument III) produced a grand mean for the CG of 3.960. The grand mean of the ETG I was 3.918 and the grand mean of the ETG II was 4.069. For the comparison of the control versus the experimental treatment groups statistical analysis yielded an F ratio of 0.06 and an associated probability of .8000 (not significant at .05). Comparison of ETG I and ETG II yielded and F ratio of 1.14 and an associated probability of .2866 (See Table 4).

Table 4. Planned Orthogonal Contrasts of the Posttest Means of the Variable Group Locus of Control Instrument III

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	0.058	0.058	0.06	.8000 (n.s.)
Treatment I vs Treatment II	1	1.037	1.037	1.14	.2866 (n.s.)

n.s. = not significant

Based on these analyses, the students in ETG I did not demonstrate statistically significant higher levels of group locus of control when compared to students in ETG II. Also, when compared to the CG, the ETG I and ETG II students did not demonstrate statistically significant higher levels of group locus of control.

Findings and Conclusions of Knowledge of Citizenship Action Skills

Posttest analysis of covariance on the data collected for the variable Knowledge of Citizenship Action Skills (Instrument IV) indicated a grand mean for the CG of 1.133. The grand mean of the ETG I was 1.898 and the grand mean of the ETG II was 1.806. For the comparison of the control versus the experimental treatment groups, statistical analysis yielded an F ratio of 10.08 and an associated probability of .0017 (significant at .05). Comparison of ETG I and ETG II yielded and F ratio of 0.12 and an associated probability of .7289 (See Table 5).

Table 5. Planned Orthogonal Contrasts of the Posttest Means of the Variable Knowledge of Citizenship Action Skills Instrument IV

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	33.193	33.193	10.08	.0017*
Treatment I vs Treatment II	1	0.397	0.397	0.12	.7289 (n.s.)

* = significant at .01
n.s. = not significant

The students in ETG I did not demonstrate statistically significant higher levels of knowledge of citizenship action skills when compared to the ETG II students. Statistically significant higher levels of knowledge of citizenship action skills were demonstrated when students in ETG I and ETG II were compared to students in the CG.

Findings and Conclusions for Perveied Skill in Use of Citizenship Action Skills

Posttest analysis of covariance on the data collected for the variable perceived skill in use of citizenship action skills (Instrument V) indicated a grand mean for the CG of 11.347. The grand mean of the ETG I was 11.980 and the grand mean of the ETG II was 12.639. For the comparison of the control versus the experimental treatment groups, statistical analysis yielded an F ratio of 3.98 and an associated probability of .0472. Comparison of ETG I and ETG II yielded and F ratio of 1.00 and an associated probability of .3191 (See Table 6).

Table 6. Planned Orthogonal Contrasts of the Posttest Means of the Variable Perceived Skill In Use of Citizenship Action Skills Instrument V

Contrast	df	Sum of Squares Type III	Mean Square	F Ratio	Probability
Control vs. Treatments	1	47.181	47.181	3.98	.0472*
Treatment I vs Treatment II	1	11.816	11.816	1.00	.3191 (n.s.)

* = significant at .05
n.s. = not significant

The students in ETG I did not demonstrate statistically significant higher levels of perceived skill in the use of citizenship action skills when compared to students who received instruction containing only knowledge and awareness of environmental issues (ETG II). Statistically significant higher levels of perceived skill in the use of citizenship action skills were demonstrated when students in ETG I and students in ETG II were compared to students in the CG.

Table 7 provides a summary of the posttest data. Columns two, three and four list the posttest group means for the treatment and control groups by variable. Column five lists the probability level of the contrast between the control group and the treatment groups first followed by the probability level for the contrast of ETG I versus ETG II.

Table 7. A Summary of Posttest Group Means and Associated Probabilities for the Variables Examined in this Study

Variable Name	ETG I Means	ETG II Means	Control Group Means	Probability (alpha=.05) CG vs ETG I and I ETG I vs ETG II
Knowledge of Ecological Foundations	12.864	11.475	10.007	.0046 ** .5424 n.s.
Overt Environmental Behavior	2.340	1.529	0.969	.0001*** .0074 **
Individual Locus of Control	3.143	3.098	2.787	.0152 * .6871 n.s.
Group Locus of Control	3.918	4.069	3.960	.8000 n.s. .2866 n.s.
Knowledge of Citizenship Action Skills	1.898	1.806	1.333	.0017 ** .7289 n.s.
Perceived Skill in use of Citizenship Action Skills	11.980	12.639	11.347	.0472 * .3191 n.s.

* = significant at .05
** = significant at .01
*** = significant at .001
n.s. = not significant

Discussion

Significant Findings

The statistically significant findings related to the variable overt environmental behavior reported for this study are consistent with the findings of previous research (Holt, 1988; Klingler, 1980; Ramsey, 1987, 1979; Simpson, 1989). These research studies demonstrated that formal instruction in issue investigation/evaluation and action skills training was responsible for producing a positive increase in overt environmental behavior.

The increase of the posttest means on this variable from the ETG II to the control group infers that this treatment, which contained instruction only in knowledge and awareness of environmental issues, might also be responsible for a slight increase in overt environmental behavior. This inference, while not supported by the research hypotheses of this study, does have limited acceptance within the field of environmental education. This is evidenced by several research studies (Dispoto, 1977; Ramsey & Rickson, 1977; Young, 1980) which state that knowledge and awareness of issues can change environmental behavior. It should be noted, however, that overt environmental behavior does not increase to the extent indicated when using investigation/evaluation and action skills training materials (Ramsey, 1979).

Nonsignificant Findings

A substantial part of responsible environmental behavior is the result of the relationship with the variables (1) knowledge of citizenship action skills, (2) perceived skill in use of citizenship action skills, (3) group locus of control, and (4) individual locus of control (Marcinkowski, 1989; Sia, 1984; Sivek, 1988). Hines (1987) published a meta-analysis of the research on environmental behavior which identified the "best" predictors of environmental behavior. The same four variables as described above were again identified in this study as important predictors of environmental behavior. Specifically, the variables knowledge of citizenship action skills and perceived skill in use of citizenship action skills were shown by Sia (1984) to be strong predictors of responsible environmental behavior. Sia concluded that the more skillful in citizenship action skills and the more knowledgeable of action strategies an individual is, the greater the probability that this individual will behave in an environmentally responsible manner.

Although the data from this study on perceived skill in use of citizenship action skills are inconclusive, the data for the variable knowledge of citizenship action skills presents consistent and orderly results. Again these data are not statistically significant but do suggest evidence of increased levels of knowledge of citizenship action skills among the groups.

The variable knowledge of ecological foundations has been examined in this study, for the first time, along with the other dependent variables in regards to comparison of

achievement using the ECS. This variable also takes on greater importance when the ECS model is considered since the content of the ECS includes foundational knowledge for the particular issue under study (in this study wetland issues). The means of the groups appear to be orderly and consistent in the desired direction of achievement. This might be expected considering that the total treatment for ETG II was also included in the treatment for experimental treatment group I. That is to say, that both groups received similar training in the ecological foundations and issue awareness concerning wetland issues.

This study, along with previous research studies demonstrate, with varying degrees of success, that the variables studied here help explain and account for the development of responsible environmental behavior. It should be pointed out that the relationships between these variables and environmental behavior appear to be complex and not completely understood. Hines (1987) summarizes this by stating that a degree of uncertainty still exists in the prediction of environmental behavior due to the complexity of the process which is based on a multitude of factors.

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